

6.EE.1 Exponents

Starting Task ~ The Genie's Offer

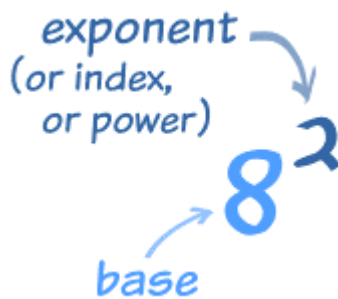


After opening an ancient bottle you find on the beach, a Genie appears. In payment for his freedom, he gives you a choice of either 50,000 gold coins or one magical gold coin. The magic coin will turn into two gold coins on the first day. The two coins will turn into four coins total at the end of two days. By the end of the third day there will be eight gold coins total. The Genie explains that the magic coins will continue this pattern of doubling each day for one moon cycle, 28 days. Which prize do you choose?

Take a few minutes to decide. Then, discuss your decision with your elbow partner.

Read "One Grain of Rice" by Demi

6.EE.1 ~ Exponents



The **exponent** of a number says **how many times** to use the number in a multiplication.

In 8^2 the "2" says to use 8 twice in a multiplication,
so $8^2 = 8 \times 8 = 64$

Exponents are also called Powers or Indices.

- In words: 8^2 could be called "8 to the power 2" or "8 to the second power", or simply "8 squared"

Some more examples:

Example: $5^3 = 5 \times 5 \times 5 = 125$

- In words: 5^3 could be called "5 to the third power", "5 to the power 3" or simply "5 cubed"

Example: $2^4 = 2 \times 2 \times 2 \times 2 = 16$

- In words: 2^4 could be called "2 to the fourth power" or "2 to the power 4" or simply "2 to the 4th"

Exponents make it easier to write and use many multiplications

Example: 9^6 is easier to write and read than $9 \times 9 \times 9 \times 9 \times 9 \times 9$

You can multiply **any** number by itself **as many times** as you want using exponents.

Other Way of Writing It

Sometimes people use the \wedge symbol (just above the 6 on your keyboard), because it is easy to type.

Example: 2^4 is the same as 2^4

$$\cdot \quad 2^4 = 2 \times 2 \times 2 \times 2 = 16$$

What if the Exponent is 1, or 0?

1 If the exponent is 1, then you just have the number itself (example $9^1 = 9$)

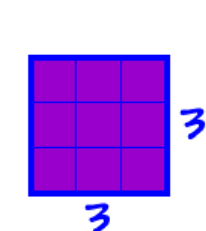
0 If the exponent is 0, then you get 1 (example $9^0 = 1$)

But what about 0^0 ? It could be either 1 or 0, and so people say it is "*indeterminate*".

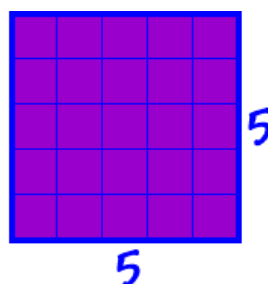
Let's look at powers of 10 using a table:

10^1	10 to the first power	$10 = 10$
10^2	10 to the second power	$10 \times 10 = 100$
10^3	10 to the third power	$10 \times 10 \times 10 = 1,000$
10^4	10 to the fourth power	$10 \times 10 \times 10 \times 10 = 10,000$
10^5	10 to the fifth power	$10 \times 10 \times 10 \times 10 \times 10 = 100,000$

We can also use exponential equations to show Area

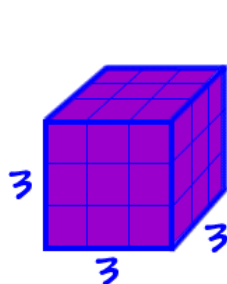


area:
 $3^2 = 9$

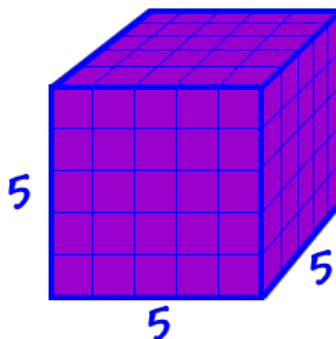


area:
 $5^2 = 25$

or Volume



volume:
 $3^3 = 27$



volume:
 $5^3 = 125$

Now, let's go back to the Genie's Offer and write the following:

- Write an exponential expression for the number of coins there will be on the third day.
- Make a table to show how the number of coins grew.
- Write an expression for the number of coins there will be on the 28th day.
- Would you have more or less than a million coins on the 28th day? Explain.

Assignment Task:

Certain biological cells quadruple (multiply by 4) each hour. Start with one cell at 2:00 and find out how many cells there will be by 5:00. Create a diagram or table to represent the cell growth. Include an equation using exponential notation.

Extra Credit (5 points):

Every positive integer can be expressed as the sum of four or fewer squared numbers (Note: You can use the same integer more than once.)

Examples:

$$5 = 1^2 + 2^2$$

$$101 = 4^2 + 6^2 + 7^2$$

$$170 = 2^2 + 6^2 + 7^2 + 9^2$$

Write 83 as the sum of three square numbers.

6.EE.1 ~ Exponent Quiz

1. At Russell's school, one person will contact 4 people and each of those people will contact 4 other people, and so on. How many people will be contacted in the fifth round?
2. Write an equation using exponential notation to show how you found the answer to #1.
3. To save money for a video game, you put one dollar in an envelope. Each day, for 5 days you double the number of dollars in the envelope from the day before. How much will be saved on the fifth day?
4. Make a table of exponents to show how the money grows in problem #3.
5. Write an equation showing the total money saved in problem #3 using exponential notation.